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(54) Communication method

(57) The present invention relates to establishing a communication channel between two communication systems having computer telephony integration (CTI). Many CTI systems are configured into incoming and outgoing lines according to the anticipated demands. Consequently, if sufficient outgoing or incoming capacity is unavailable at a given time to support a communication channel of required characteristics, the users of such a system must conventionally wait until sufficient capacity becomes available. However, the present invention determines who the intended addressee is and can instruct the CTI system associated with that addressee to instigate the establishment of a communication channel to the user who originally desired the connection. The instructions can be sent to the intended addressee using for example, another communication network, such as the Internet or other data communications network. This arrangement also allows the call to be placed in the reverse direction, where this is favourable for tariff reasons.

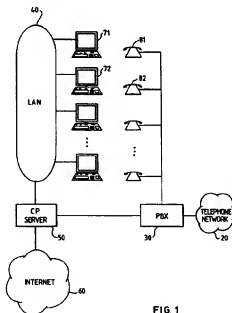
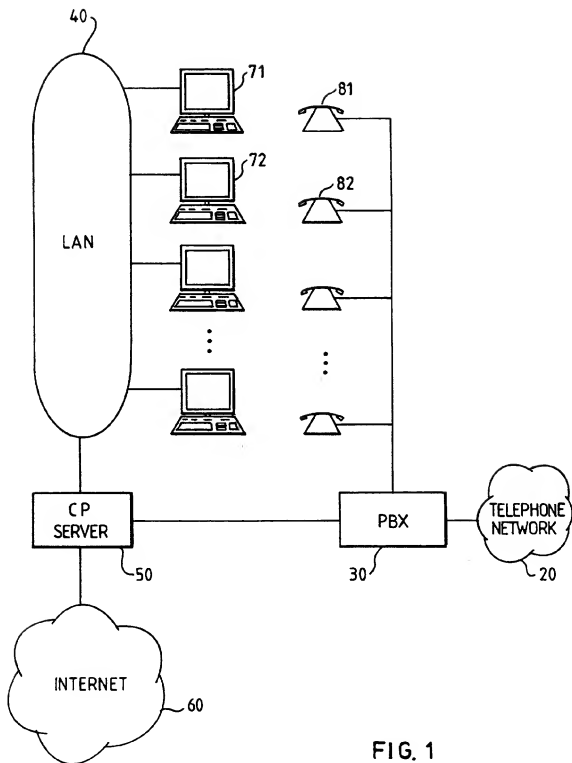
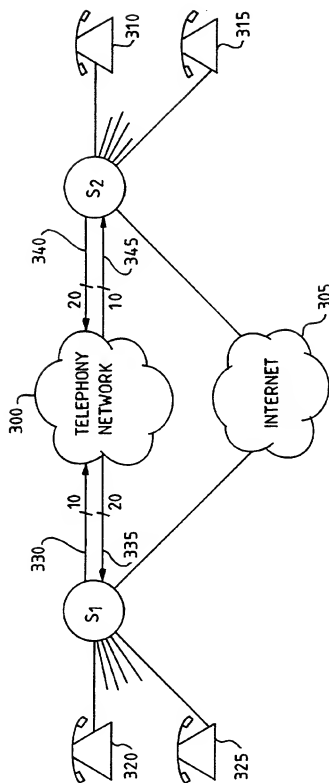


FIG. 1



FIG. 2

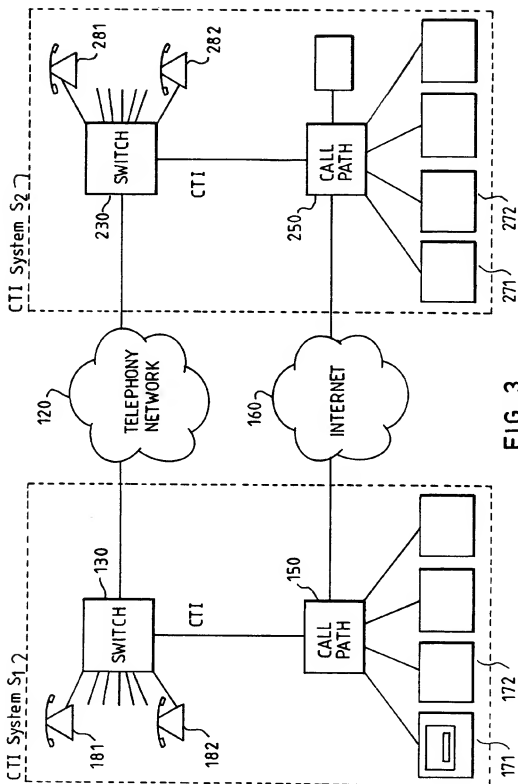
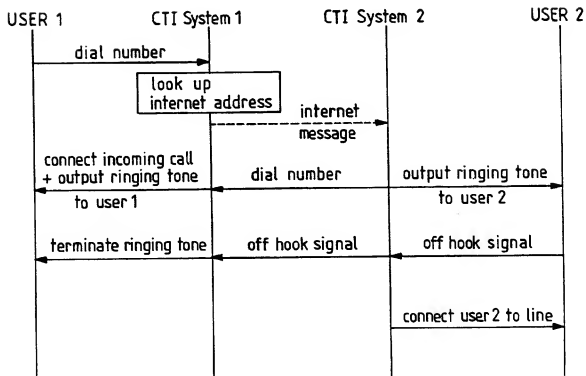
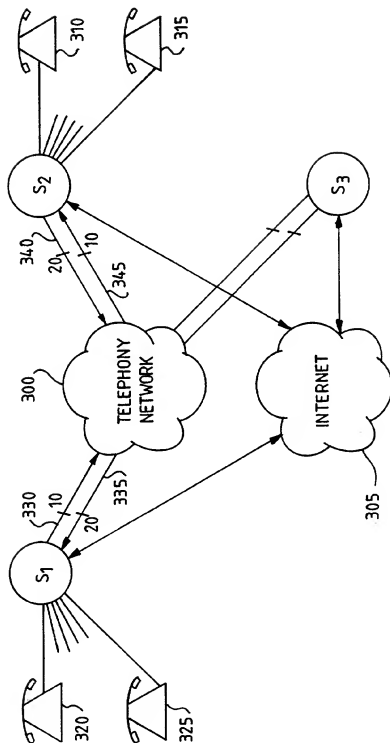
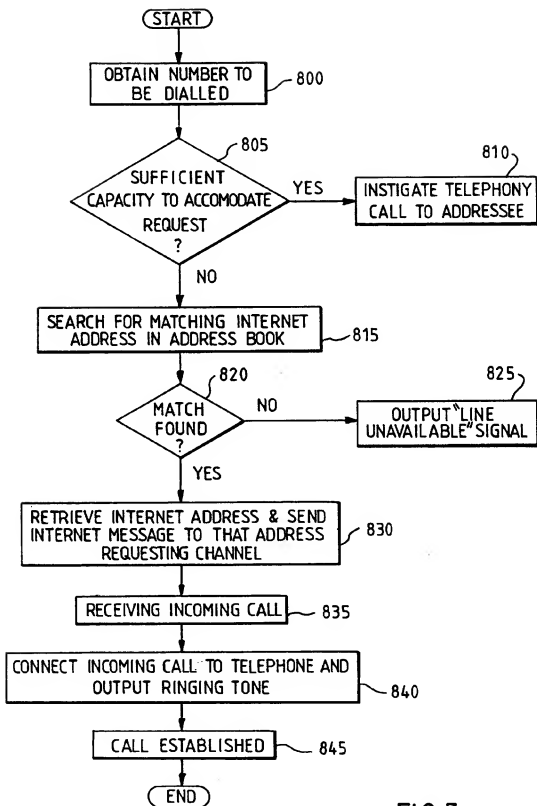


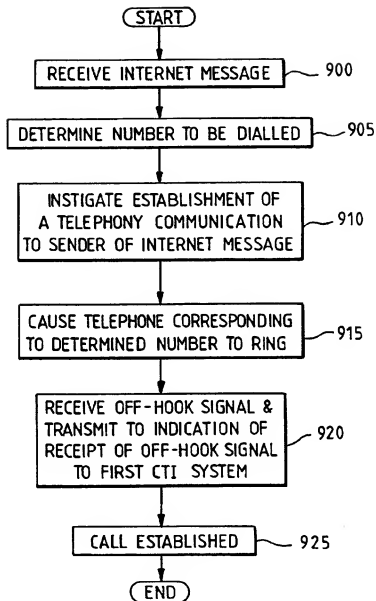
FIG. 3

NUMBER	ADDRESS	500
No 1	ADDRESS 1	
No 2	ADDRESS 2	510
.	.	
.	.	
No N	ADDRESS N	

FIG. 4FIG. 5

**FIG. 6**

FIG. 7

**FIG. 8**

COMMUNICATION METHOD AND SYSTEM

5 The present invention relates to a method and system for establishing a communication channel between first and second communication systems.

10 Telephony or communication systems used by large organisations, such as banks, insurance companies and the like, have, as part of their daily operation, the need to be able to support a significant number of telephone enquiries. The communication systems of such large
15 organisation are configured according to the specific needs of that organisation. For example, a large car insurance organisation may require a significant number or high availability of incoming lines in anticipation of a large number of incoming calls from parties soliciting car insurance quotes. However, the number of outgoing lines may be appreciably less than the number of incoming lines in such a scenario due to the relatively low anticipated outgoing traffic. In contrast, a
20 telesales organisation would require a significant number or high availability of outgoing lines by which potential customers of the organisation can be contacted and the anticipated incoming traffic may be relatively less.

25 With prior art telephony systems, if a user of a telephone in an organisation having a switch configured above wishes to establish, say, an outgoing call, and all outgoing lines are currently fully utilised, that user will have to wait until an outgoing line or sufficient outgoing capacity is available. Similarly, if a third party wishes to call that
30 user and all of the incoming lines to that organisation are busy, that third party would have to wait until an incoming line is available.

 The same situation may arise with any communication system which has a limited bandwidth over which information or data can be
35 transmitted. For example, with a multi-media computer capable of generating a plurality of information media types, such as video, data or sound, if there is insufficient outgoing capacity to support a communication link between, say, two such computers used for collaborative or group working, then users of those computers will have
40 to wait until sufficient outgoing capacity to support communication therebetween is available.

Another concern that has arisen is the asymmetric nature of telephone costs. In other words, the price of a call of a given length between A and B may depend on whether A initially dialled B, or vice versa. These differences tend to be particularly significant for international calls, but may also exist for example where the parties are very disparate in size, and one has negotiated a discounted rate in view of its high volume of calls. However, it has been very difficult in the past to be able to exploit such charging differences in order to minimise call costs.

Accordingly, the invention provides a method for establishing a communication channel between first and second communication systems connected by at least one communication network, the method comprising the steps of

requesting the establishment of a communication channel between the first and second systems,

determining whether the first or second communication system should establish the communication channel, and

establishing the communication channel according to the determination.

Thus the invention permits the establishment of the communication channel to be instigated either at the system which originally requests the call, or at the system which is the originally intended recipient of the call. Typically, the communication channel is established over the public telephone network. Since the instigator of a call generally receives the charge for the call, this method is most useful where both the first and second communication systems belong to the same corporate organisation (although of course the use of Freephone numbers would give added flexibility).

There are two main situations in which the above facility is of particular benefit. The first situation is where the tariffs for the same communications channel differ according to whether it is set up by the first or second communication system. The second situation is where at least one of the communication systems has at least some dedicated incoming or outgoing communication lines. This is typically case where for example the first communication system represents a telemarketing system, which will have a large number of lines assigned to outgoing calls, and relatively few to incoming calls (nb this is generally a

logical assignment only, since essentially all physical connections are capable of bi-directional support).

In this latter situation, the step of determining preferably comprises the steps of

establishing whether or not sufficient outgoing channel capacity is available from the first system to the second system to support the communication channel, and

transmitting, in response to establishing that there is insufficient available outgoing channel capacity from the first system to support the communication channel, a message to the second system requesting the second system to instigate the establishment of the communication channel.

Thus if the first communication system does not have sufficient outgoing capacity for the communication channel (or does not want to use what is available), then it can send a message to the second communication system, asking for the channel to be established in reverse. An analogous situation can arise when a call comes through to the second communication system, which does not have sufficient incoming capacity to receive the call. Here the second communication system can respond by notifying the first communication system accordingly, and then set up the call itself. Note that the lack of channel capacity may represent a complete lack of outgoing/incoming lines as appropriate, or a restriction on bandwidth such that the requested communication channel can only be set up in one direction. For example, the system may desire to transmit video information to the second system, but there is insufficient outgoing capacity supported at that moment for such a connection.

In the situation where the calling cost arrangements may be asymmetric between the first and second communication systems, the step of determining preferably comprises ascertaining whether or not it is more cost effective to instigate the establishment of the communication channel at the first or second communication system.

Such an asymmetry in costs may arise where the tariff is dependent upon the amount of outgoing traffic from a location. Also the cost of a call may vary as a function of time with higher costs being incurred during peak traffic hours. For example, it may be very expensive to establish a communication link between two communication systems, one of

which is located in the US and the other of which is located in the UK, if the UK communication system outgoing link is established during peak UK hours. The UK off-peak hours may be such that both parties would not be simultaneously available. However, it may be possible to initiate the call from the US under US off-peak rates, even although these may partly overlap in time with UK peak hours. Another possibility is that different locations may be served by different telephone companies which have different call rates.

In one preferred embodiment, this step of determining at which end to initiate the connection is performed at a third communication system connected to said first and second communication systems by said at least one computer network. Typically this third system maintains data relating to the first and second communication systems for use in the step of determining, said data including data representative of the prevailing call tariffs at said first and second communication systems. The data is generally updated by said first and second communication systems, for example whenever their respective call tariffs change. The third system can belong to the same organisation as the first and second communication systems, or might be available as a service offering from a third party supplier. Typically the third system is attached to the Internet, and can perform this function for many other communication systems which are also attached the Internet. Note that this third system may in fact be coincident with either the first or second communication systems, or may be distributed or replicated across the network.

The operation with the third system if the first communication system desires to initiate a communication channel with the second communication system may be approximately as follows. The first communication system transmits an indication of its desire to the third system, which determines the direction which will minimise the cost of the call. This can be based on tariff information stored in or accessible to the third system, or as a result of interrogating the second communication system (assuming that the first communication system could provide its own tariff information with the set-up request). The third system then notifies whichever communication system is appropriate to instigate the call in the preferred direction. Alternatively, the response may always go to the first communication system, which then instructs the second communication system to instigate the call where appropriate.

If no third system is used, then the first and second communication systems can negotiate to determine which of them should instigate the call. For example, the first system could pass a request for a call to the second system, along with tariff information prevailing at the first system. The second system would compare this tariff information with its own tariff information, and depending on the resultant cost situation, either instigate the call itself, or send a response to the first system indicating that it should instigate the call there. A slightly different approach would be for the first system to initially request tariff information from the second system. The determination as to the preferred direction would then be performed at the first system, with the second system being requested to instigate the call where appropriate.

Assuming that it is the first communication system that initially desires to set up the communication channel, then typically it waits a predetermined period of time for a response to its transmission to the second or third system as appropriate. In the absence of any reply within said predetermined time period, the first communication system tries to establish the communication channel itself in conventional fashion.

The invention exploits the increasing use of CTI systems to provide sophisticated call handling facilities at call centres and other locations that process a relatively large number of incoming and/or outgoing telephony calls. Such CTI systems effectively allow centralised monitoring and control of each extension. Traditionally these CTI systems have operated independently from one another.

The invention however recognises that the very wide acceptance of the Internet to link computers together offers the possibility of integrating CTI systems together to provide new functionality, including the ability to instigate a call in the least cost direction. In particular, it is recognised that CTI systems connected by the Internet (in addition to the conventional telephone network) have a means of low cost signalling with one another that can be exploited to provide this new functionality. Of course, the end to end delay over the Internet tends to be somewhat greater than over the conventional telephone network, but for call set-up a delay of a couple of seconds is not normally significant. Moreover, a time-out provision is preferably used, so that if the Internet delays become too severe, then prior art call placement techniques are used by default.

It will be appreciated that the Internet provides all the networking required to support communications between different CTI systems, effectively transparently to the user. Thus one CTI system can communicate with another CTI system over the Internet quickly and easily, without requiring any knowledge of the underlying network structure supporting the communication (eg which gateways to use, and so on). It will further be recognised that exploiting the Internet infrastructure is a very cost-effective way of communicating between sites as compared to the use of, for example, leased lines or the telephony network.

The invention further provides apparatus for establishing a communication channel between first and second communication systems connected by at least one communication network, comprising

- means for receiving a request for the establishment of a communication channel between the first and second systems,
- means for determining whether the first or second communication system should establish the communication channel, and
- means for initiating the establishment of the communication channel according to the determination.

Embodiments of the invention will now be described, by way of example only, with reference to the following drawings in which:

Figure 1 illustrates a typical installation having computer telephony integration (CTI);

Figure 2 illustrates schematically two CTI systems such as shown in Figure 1, connected both by the telephone network and by the Internet;

Figure 3 illustrates in greater detail the arrangement depicted in Figure 2;

Figure 4 shows schematically an address book for mapping a telephone number to a corresponding Internet address;

Figure 5 shows the signal exchange of the arrangement of Figure 2 in setting up a telephone connection;

Figure 6 shows schematically a variation on the embodiment of Figure 3, where a third system is involved in the call set-up decision; and

Figures 7 and 8 are flow charts illustrating the method of establishing a communication channel between two CTI systems such as shown in Figure 2.

Figure 1 illustrates a typical system with computer-telephony integration (CTI). The telephony side of the system comprises a switch or

PBX 30, which is attached to the public telephone network 20, to allow access to and from external parties. Attached to the PEX in known fashion are a plurality of telephone extensions 81, 82, which are assigned to respective agents. Each agent also has a client personal computer or workstation 71, 72, which is attached via a local area network 40 to a server machine 50. Typically the server and client use the well-known TCP/IP protocol for their communications. The server also has a computer link to the PBX 30, possibly via an intermediate protocol conversion system (not shown).

An example of the use of the CTI system of Figure 1 is to provide information about a caller on the terminal of the agent who is about to receive that call. Thus when an incoming call is received, it may be possible to identify the caller based on the calling or called number (ANI/DNIS information). The PEX therefore passes ANI/DNIS information received from the network to the server, which uses this information to access relevant details about the caller. The server can then instruct the PBX to route the call to a particular extension (for example to an agent who has dealt with this caller previously), and at the same time cause the retrieved information about the caller to be displayed on the client screen. Another example of the use of the CTI system is intelligent dialling, whereby a caller selects a number from his or her screen. This then passes a message to the server, which in turn instructs the PBX to dial out to that number, and connect the call when answered to the extension of the relevant agent.

It will be appreciated that the CTI system illustrated in Figure 1 is very well-known in the art. One example is based on the Callpath system available from IBM, where for example the server may comprise the Callpath Server/2 program running on an IBM PS/2 workstation or equivalent under the OS/2 operating system, or the AIX Callpath Server/6000 program running on a RISC System/6000 workstation. Each client may comprise an IBM PS/2 workstation or equivalent running the OS/2 operating system or the Microsoft Windows operating system, and a RISC System/6000 workstation running the AIX operating system. The clients and server may communicate using the TCP/IP protocol over a Token Ring or Ethernet local area network. Further information about the Callpath products can be found in the Callpath manuals available from IBM Corporation, such as IBM Callpath Coordinator for OS/2 and Windows General Information (order number GC22-0074) and the manuals referenced therein.

As shown in Figure 1, the server 50 is also connected to the Internet 60. Such a connection is not required for operation as a conventional CTI system, but is very straightforward for the skilled person to implement in view of the fact that the server already supports the TCP/IP protocol which is used for Internet communications. Such support is typically provided as part of the operating system running on the server, and is described for the AIX operating system (for example) in "AIX v4.1 System User's Guide: Communication and Network" (publication SC23-2545-01) and "AIX v4.1 Communications Programming Concepts" (publication SC23-2610-01) (both available from IBM Corporation).

Figure 2 shows two CTI systems S_1 and S_2 , substantially as described above with reference to Figure 1, connected to each other firstly via the public telephone network 300 and secondly via the Internet 305. It will be appreciated that although the Internet is depicted as a separate network, in practice the Internet support structure may be provided by the same physical telephony network. Nevertheless, from the perspective of the users of S_1 and S_2 , the two networks are logically distinct. Each CTI system is capable of supporting a plurality of telephones 310 or other communication/data transmission devices such as facsimile machines, and so on. Typically the first and second CTI systems S_1 and S_2 both belong to the same organisation, such as a large corporation.

Assume that the first CTI system, S_1 , has the following telephony traffic capacity: ten outgoing lines 330 and twenty incoming lines 335, and that the second CTI system, S_2 , has twenty outgoing lines 340 and ten incoming lines 345. Furthermore, assume that all ten outgoing lines 330 of the first CTI system S_1 are busy and a user thereof wishes to establish a call with a user of the second CTI system S_2 . The user of the first CTI system S_1 dials in the conventional manner the telephone number of the intended addressee who can be reached via second CTI system S_2 . The first CTI system S_1 then makes a determination as to whether or not sufficient outgoing capacity is available to support a telephony connection. In the instant case the result of the determination will be that an outgoing call cannot be supported due to insufficient available outgoing capacity.

The first CTI system S_1 contains an address book 500 or file, schematically represented in Figure 4, which contains a list 505 of telephone numbers together with their corresponding Internet addresses 510. Upon making such a determination, the first CTI system, S_1 , then

matches the dialled number with a number stored in the address book 500 and retrieves the corresponding Internet address of the CTI system associated with that dialled number, that is, the second CTI system S_2 . The first CTI system S_1 forwards an Internet message to the second CTI system S_2 using the corresponding Internet address. The message sent via the Internet contains sufficient information to allow the second CTI system S_2 to instigate a call to the first CTI system S_1 . Upon receiving the Internet message, the second CTI system S_2 instigates a telephony call to the appropriate party who initially attempted to instigate the call and also causes the telephone of the intended addressee to ring. The intended addressee is a user of the second CTI system S_1 . The first CTI system S_1 upon receiving the incoming call from the second CTI system outputs to the telephone of the first user a ringing tone. When the second CTI system S_2 detects an off-hook or equivalent signal, an indication that the second user U_1 has answered is transmitted to the first CTI system S_1 . The second CTI system concurrently connects the second user's telephone to the telephony connection established between the CTI systems S_1 and S_2 . The first CTI system S_1 , responsive to the off hook signal, terminates the ringing tone and connects the first user U_1 to the telephony connection established between the CTI systems S_1 and S_2 thereby establishing the requisite telephony link between the two parties.

The signalling underlying the above implementation is shown schematically in Figure 5. Initially User 1 specifies a telephone number of the intended addressee, either using telephone extension 81 or terminal 71, and this is passed to the server 50, via PBX 30 or LAN 40 as appropriate (in some situations, such as in telephone polling, the intended addressee may be automatically selected for the user). It is assumed that this results in the first user going off-hook. The first CTI system then uses a look-up table such as that shown in Figure 4 to obtain the Internet address of the CTI system supporting the intended call recipient. Note that this look-up table need not necessarily reside on the server, but could for example be accessed remotely over the Internet 60 (provided of course that the server knows the location of the table).

The first CTI system then transmits an Internet message containing the telephone number of the original initiator of the call to the second CTI system, which responds by outputting a ringing tone to the intended addressee of the call, User 2, who is also identified in the received Internet message, and also dials out to the first CTI system. On receipt

of this incoming call, the first CTI system connects the call to User 1, and outputs a ringing tone. When User 2 finally answers, this results in the establishment of the call between User 1 and User 2 in known fashion.

5 It will be appreciated that Figure 5 does not depict the actual determination as to whether or not the call should be instigated in the reverse direction. This determination could be performed at either the first or second CTI system, or at a third system (see below). For example, if the determination was to be made at the first system, it
10 might be performed directly after the number was originally dialled, in the situation where incoming lines but no outgoing lines were available.

 Although the above embodiment has been described in terms of a communication between conventional telephony users of the CTI systems,
15 the present invention is not limited thereto. For example, applications executing on the respective system which require a communication channel therebetween for data exchange may adopt this approach. In such case there may be outgoing lines available, but these may not have sufficient bandwidth for the desired form of data connection (perhaps a video link
20 for example). Thus this approach can be adopted where there is more bandwidth available on the incoming lines than on outgoing lines.

 It will also be appreciated that the above approach may be used to balance channel usage. For example, where a high fraction of outgoing
25 lines are already in use, but only a small fraction of available incoming lines, then it may be desirable for new calls to use the incoming lines rather than risk saturating the outgoing lines. This is particularly important because there are likely to be some calls for which the direction of call is not flexible. For example, users of CTI system S_1
30 may also be contacting individual users at home, where no CTI control is available.

 Referring again to Figure 2, an alternative scenario can be envisaged in which the first CTI system S_1 has sufficient outgoing
35 capacity but insufficient incoming capacity to support an incoming telephony call instigated by the second CTI system S_2 . The second CTI system S_2 , when attempting to establish a connection with the first CTI system S_1 , would receive a signal from the telephone network 330 indicating that the first CTI system S_1 cannot accommodate the
40 connection. The second CTI system S_2 therefore determines the Internet address of the first CTI system S_1 using an address book 500 as depicted

in Figure 4 and sends a message thereto indicating that the first CTI system S_1 should establish an outgoing call to the second CTI system S_2 . Again, assuming the first CTI system S_1 has sufficient outgoing capacity, that system will instigate the establishment of a telephony connection to the second CTI system S_2 . The signalling is then analogous to that described for the preceding example. An alternative approach would be for the first CTI system, S_1 , to initiate the call directly, when it receives an incoming call from the second CTI system, S_2 , which it is not able to accept, thereby reducing the amount of messaging required between the two CTI systems.

The messages exchanged between the CTI systems may contain various data describing, for example, the type of communication channel to be established or the characteristics of the required channel, such as bandwidth, quality of service, acceptable error rates etc, or the local cost of instigating a call together with the telephone number to be dialled and the calling number.

It will be appreciated that although the lines have been described as either incoming or outgoing, the physical lines themselves are conventionally duplex lines and have both incoming and outgoing traffic carrying capabilities, but are simply logically assigned as being either incoming or outgoing. The assignment of incoming or outgoing traffic carrying capacities of the lines can be varied, but often this is controlled by a subscription to the local telephone carrier, and so cannot be performed in real-time by the owner of the CTI system.

Referring to Figure 3, this shows two linked CTI systems, similar to those individually depicted in Figure 1, which underlie the architecture of the communication arrangement depicted in Figure 2.

A user of such a CTI system can instigate a call to another telephone using one of at least two methods. Firstly, in one embodiment, the user can dial the number of the intended addressee in the conventional manner using their telephone extension 181. The switch 130 forwards that number to the server 150 via the server-switch link. The server then determines whether the call connection should be instigated locally or whether the call connection should be instigated by the intended addressee at the remote system as previously described. If the determination is such that the call should be instigated locally, the CTI system instigates the establishment of the call by controlling the switch

in the conventional manner. However, if the determination is such that the call should be instigated by the intended addressee, the processing continues as described above in relation to Figure 2. Typically, the server 150 determines the Internet address of the server 250 associated with the intended addressee and forwards an Internet message to that server containing an indication that the telephony connection should be instigated between the users and the appropriate telephone numbers of the parties between whom the connection is to be established.

In an alternative embodiment, the telephone number of the intended addressee can be entered using a Web browser running on a client terminal 171 which has accessed an appropriate page on the server 150. This page may represent a directory of all the users in the corporation. The user of the client terminal enters the telephone number of the intended addressee using an input field with a Web Browser in known fashion, which the Web Browser then submits to the server 150, or the user may perhaps simply select the name of the intended addressee, with the server converting this into a telephone number. In response to receiving the telephone number from the user, the server launches an instance of an application which determines, in a manner substantially described above, whether the telephony call should be established locally or remotely based upon predeterminable criteria such as channel availability. Generally the application will be run on the server, although conceivably it could be downloaded onto the client itself.

In the preceding embodiments the direction of call placement has been based on the availability of incoming and outgoing lines. However, in another preferred embodiment, the direction of call placement is determined by whether it is more cost effective to instigate the call from, for example, the second CTI system S_2 , due to different prevailing call tariffs, rather than from the first CTI system S_1 . For example, assume that the cost of a telephone call instigated from the first CTI system S_1 is X whereas that of the second CTI system S_2 is Y , where $X > Y$. It would be more cost effective to instigate the telephone call from the second CTI system S_2 rather than from the first CTI system S_1 . Therefore before establishing a communication channel between the first S_1 and second S_2 CTI systems a determination is made as to which CTI system should instigate the call. Thus if CTI system S_1 receives a telephone number dialled by a user U_1 thereof, a determination as to the cost situation is made using an extended form of the address book 500. Such an extended address book also contains an indication of the call tariff

prevailing at the remote location corresponding to the dialled number. The first CTI system S_1 identifies the dialled number in the address book 500 and determines this remote call tariff. If the determined call tariff is greater than the local call tariff at S_1 , the first CTI system 5 S_1 instigates the call. However, if the determined remote call tariff of the second CTI system S_2 is less than the local call tariff of the first CTI system S_1 , the first CTI system S_1 sends a message to the second CTI system S_2 via the Internet indicating that a telephony channel should be established between the CTI systems and ultimately the users of the 10 systems. The signalling involved in realising the telephony connection and content of the Internet message are substantially as described above.

The differing call tariffs may arise as a consequence of, for 15 example, the CTI systems being located different countries or one CTI system having a significantly larger number of leased telephony lines and thereby being able to benefit from economies of scale when negotiating the cost of the leased lines, or as a consequence of being located in different geographic areas serviced by different telephony companies.

20 An alternative approach is for the first CTI system S_1 to send a message to the second CTI system S_2 via the Internet containing an indication of the number to be dialled, the calling number, and the prevailing call tariff at the first CTI system S_1 . The second CTI system 25 S_2 receives the Internet message and determines whether it is more cost effective for it to instigate the establishment of a telephony call or vice versa. If the determination is such that the overall cost of establishing a telephony connection between the first S_1 and second S_2 CTI systems is less if second CTI system S_2 instigates the call, then that 30 second CTI system S_2 instigates the call to the first CTI system S_1 using the number or other identifier provided by the Internet message. However, if the determination is such that it is more cost effective that first CTI system S_1 establishes the call the second CTI system S_2 sends, 35 via the Internet, a message to the first CTI system S_1 indicating that the telephony call should be established by the first CTI system S_1 .

A variation on the above is for the second CTI system S_2 not to send a return message, with the first CTI system S_1 merely waiting a predetermined period of time for such a return message. If no such 40 return message is forthcoming within the predetermined period of time, then the first CTI system S_1 assumes that the determination made by the

second CTI system S_2 is such that the telephony call should be established by the first CTI system S_1 . The advantage of this approach is that it reduces the amount of Internet traffic and the amount of processing performed by each CTI system.

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In another embodiment, the step of determining is undertaken by a third system S_3 . Referring to Figure 6 there is shown a communication system in which first S_1 and second S_2 CTI systems are connected to the telephony network and Internet as per Figure 2, and a third communication system S_3 is also connected thereto. The third communication system S_3 may be a CTI system or, for example, a telephony switch. Alternatively, the third system may simply be a computer, in which case it may not have any link into the telephone network 300. In any case, the third system S_3 is adapted so as to be able to exchange data with said first S_1 and second S_2 CTI systems over the Internet 305. When a user of the first CTI system S_1 dials a number using one of the telephones 320, 325 connected thereto or requests the establishment of a communication channel to the second CTI system S_2 and there is insufficient outgoing channel capacity from the first CTI system S_1 to support said communication channel, the first CTI system S_1 transmits a message to the third system S_3 via the Internet 305 indicating that a communication channel to the second CTI system has been requested. The third communication system S_3 maintains a table of data relating to both the first S_1 and second S_2 CTI systems. In this embodiment, the table contains an indication of the currently available incoming and outgoing channel capacities of the first and second CTI systems. The third system S_3 determines whether or not the second CTI system S_2 has sufficient outgoing channel capacity to accommodate the request of the user of the first CTI system S_1 . If the second CTI system S_2 does have sufficient capacity to support such an outgoing call, the third system S_3 sends a message, via the Internet 305 or another available means, to the second CTI system S_2 indicating that a communication channel should be established with the first CTI system S_1 . The second CTI system S_2 , in response to receiving the message from the third system S_3 , then instigates the establishment of a communication channel to the first CTI system S_1 in the same manner as described with reference to Figure 2. Hence, a communication channel is established between the first S_1 and second S_2 CTI systems notwithstanding the lack of availability of outgoing channel capacity at the first CTI system S_1 . Generally, when the channel is established either the first or second CTI system sends an indication to that effect to the third system S_3 which modifies the table of data accordingly. If the second CTI system S_2 does

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not have sufficient channel capacity to accommodate a channel to the first CTI system S_1 , the third system S_3 sends a message to the first CTI system containing an indication to that effect whereupon the first CTI system outputs a "line unavailable" signal to the user thereof.

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The third system S_3 may maintain the table of currently available channel capacities in at least one of a plurality of manners. The third system can periodically interrogate the first S_1 and second S_2 CTI systems to determine the currently available channel capacities and amend the table in light of the results of the interrogation. Alternatively, the first S_1 and second S_2 CTI systems may send to the third system S_3 indications of the available channel capacities as and when the capacities vary.

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Although the preceding discussion has considered line availability, the third system could also be used to control line type, line bandwidth, and so on. For example, the initial message sent to the third communication system might contain an indication of the type of the required communication channel. In this approach the third system S_3 , typically maps channel type against the typical capacities required to support such a channel and amends a table of available channel capacities accordingly. Thus if the first CTI system S_1 requires a channel of telephony type, the third system S_3 , in response to the request or the indication that the channel has been established, may deduct 3.4 kHz from the incoming and outgoing channel capacities of the first and second CTI systems respectively.

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Although the system of Figure 6 may be used for selecting route direction on the basis of line availability as described above, this has the disadvantage that the third system S_3 needs to be kept constantly informed of the current status of the first and second CTI systems. This can result in a significant overhead.

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The embodiment of Figure 6 is more appropriate where the data stored by the third communication system relates to the call tariffs prevailing at the first S_1 and second S_2 CTI systems, and where the determination made by the third system S_3 is based upon those prevailing call tariffs. This arrangement has the advantage that the tariffs are only changed infrequently. Moreover, the tariff information need only be stored at one site. Note that typically S_3 will serve as a control centre not just for the first and second CTI systems, but also for many other

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CTI systems (not shown) attached to the telephone network and the Internet.

Whilst Figure 6 depicts the third system S_3 as being remote from both the first and second CTI systems, this need not be the case. Rather, S_1 or S_2 could logically function as S_3 . Another possibility is that S_3 may be a distributed system, spread across one or more sites. There may also be more than one copy of S_3 , to provide redundancy or to improve response times. The system S_3 may belong to the same organisation as the first and second organisations, or it may belong to a third party which might be offering a call cost minimisation service to the owner (or owners) of CTI systems S_1 and S_2 .

Referring now to Figure 7, there is shown a flow chart of a method of establishing a communication channel between two CTI systems for the arrangement schematically depicted in Figure 2, from the perspective of the CTI system which originates the call. At step 800 the first CTI system S_1 obtains a number to be dialled from a user of a telephone connected to said CTI system. Alternatively, the user may select a number to be dialled from a plurality of numbers contained within a data base of telephone numbers or an address book, such as that shown in Figure 4, stored within or accessible from the first CTI system S_1 . The first CTI system S_1 determines at step 805, for example, whether or not it has sufficient outgoing channel capacity to accommodate the user's request for a telephony channel to the given number. If the first CTI system S_1 does have sufficient outgoing channel capacity, establishment of the telephony connection to the second CTI system S_2 is instigated by the first CTI system S_1 in the conventional manner at step 810. However, if the determination at step 805 is such that the first CTI system S_1 does not have sufficient outgoing capacity to accommodate the user's request, a search of the address book for a matching telephone number is made at step 815. A determination is made at step 820 as to whether or not a matching number was located. If a matching telephone number cannot be located, a "line unavailable" tone is output to the user at step 825 as the first CTI system S_1 is unable to send a message to the second CTI system S_2 soliciting the establishment of a communication channel. This would typically be the case where the call is to an external party, who is unable (perhaps because they do not have a CTI system) or unwilling to pay for the call.

In the event that a matching telephone number can be located, the Internet address associated with that number is retrieved and an Internet message is sent, at step 830, to the second CTI system containing an indication that a call should be established from that second CTI system S_2 to the first CTI system S_1 . The second CTI system then initiates the call, which is received at the first CTI system S_1 , step 835. In response to this, the incoming call is connected to the telephone of the user who first requested the call at step 840, and a ringing tone is provided. Finally, the call is established at step 845 when both parties have answered their telephones.

Referring now to Figure 8, there is shown a flow chart of a method of establishing a communication channel between two CTI systems for the arrangement schematically depicted in Figure 2, from the perspective of the CTI system which originally is to receive the call (ie this is the counterpart to the method shown in Figure 7). The second CTI system S_2 receives the Internet message at step 900 and determines the number to be dialled at step 905. The second CTI system S_2 then dials the number associated with the first CTI system S_1 thereby instigating establishment of a communication channel to the first CTI system S_1 at step 910. The telephone corresponding to number contained in the Internet message is caused to ring at step 915. Assuming the user to be present, the off-hook signal is received at step 920 and an indication to that effect is transmitted to the first CTI system S_1 via the telephony connection established between the first S_1 and second S_2 CTI systems. This leads to the establishment of the desired call at step 925.

Although the messages in the above embodiments have been transmitted or exchanged via the Internet, the present invention is not limited thereto. The messages can be exchanged using any communication channel which has sufficient capacity to support the transmission of such messages (clearly the protocol and addressing used for the messaging would have to be appropriate to whichever network was used, as is known in the art). For example one possibility would be to use a corporate intranet, which is a network having the same protocols etc as the Internet, but which, typically for security reasons, is not actually connected into the Internet. An intranet is particularly suited to the use of the invention for corporate telephone communications, where the call can be instigated by (and presumably charged to) whichever party will result in the lowest overall cost for the corporation.

The invention can also be extended to the situation where the outgoing channel capacity is insufficient to support a communication channel of the type requested by a user, but sufficient to support the transmission of a simple message indicating that the intended recipient should instigate the establishment of a communication having the requisite capacity (assuming of course that the initiator has sufficient incoming capacity). For example, a first system may wish to exchange video data with a second system. However, if there is not sufficient outgoing channel capacity from said first system to establish a video communication but there does exist incoming channel capacity to support the establishment of a video channel, then assume nevertheless that there is sufficient outgoing capacity to support an exchange of data between said first and second CAT systems: in such circumstances, the first system would transmit a message to said second system using the available outgoing channel capacity. This message would request the second system to establish a communication channel for video communications back to the first system. The systems in this example may be CTI systems, or they may be any other form of communication system having limited traffic capacity or subject to channel or cost constraints.

CLAIMS

- 5 1. A method for establishing a communication channel between first and second communication systems connected by at least one communication network, the method comprising the steps of
- requesting the establishment of a communication channel between the first and second systems,
- 10 determining whether the first or second communication system should establish the communication channel, and
- establishing the communication channel according to the determination.
- 15 2. A method as claimed in claim 1, wherein said communication channel comprises a connection over the telephone network.
3. A method as claimed in claim 1 or 2, wherein the step of determining comprises the steps of
- 20 establishing whether or not sufficient outgoing channel capacity is available from the first system to the second system to support the communication channel, and
- transmitting, in response to establishing that there is insufficient available outgoing channel capacity from the first system to
- 25 support the communication channel, a message to the second system requesting the second system to instigate the establishment of the communication channel.
4. A method as claimed in claim 1 or 2, wherein the step of determining comprises the steps of establishing whether or not sufficient incoming channel capacity is available at the second communication system for supporting the communication channel from the first communication system.
- 30 5. A method as claimed in claim 2, wherein the step of determining comprises ascertaining whether or not it is more cost effective to instigate the establishment of the communication channel at the first or second communication system.
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6. A method as claimed in claim 5, wherein said step of determining is performed at a third communication system connected to said first and second communication systems by said at least one computer network.

5 7. A method as claimed in claim 6, further comprising the step of maintaining at the third system data relating to the first and second communication systems for use in the step of determining, said data including data representative of the prevailing call tariffs at said first and second communications systems.

10 8. A method as claimed in claim 7, wherein the step of maintaining the data includes receiving updates from said first and second communication systems concerning their respective call tariffs.

15 9. A method as claimed in any of claims 6 to 8, wherein said first and second communication systems are connected to the third communication system by the Internet.

20 10. A method as claimed in claim 5, wherein said step of determining is performed at said first or second communication systems by exchanging messages therebetween.

25 11. A method as claimed in claim 10, wherein said at least one communications network comprises the Internet, and said first and second communication systems exchange messages over the Internet.

12. A method as claimed in any of claims 5 to 11, wherein the step of determining further comprises the steps of

30 transmitting a message from the first communication system, which originally desires the communication channel to be established, to said second or third communication system,

waiting a predetermined period of time for a response to the transmission, and

35 deciding in the absence of a reply within said predetermined time period that said first communication system should establish the communication channel.

13. A method as claimed in claim 1, wherein the determining comprises the steps of

40 ascertaining that there is insufficient available outgoing channel capacity from the first communication system to support the communication

channel but sufficient available outgoing channel capacity from the first communications system to transmit a request for the communication channel to be established; and

transmitting a message using said available outgoing channel capacity containing an indication that the second system should instigate the establishment of the said communication channel.

14. Apparatus for establishing a communication channel between first and second communication systems connected by at least one communication network, comprising

means for receiving a request for the establishment of a communication channel between the first and second systems,

means for determining whether the first or second communication system should establish the communication channel, and

means for initiating the establishment of the communication channel according to the determination.

15. Apparatus as claimed in claim 14, wherein said communication channel comprises a connection over the telephone network.

16. Apparatus as claimed in claim 14 or 15, wherein the means for determining comprises

means for establishing whether or not sufficient outgoing channel capacity is available from the first system to the second system to support the communication channel, and

means for transmitting, in response to establishing that there is insufficient available outgoing channel capacity from the first system to support the communication channel, a message to the second system requesting the second system to instigate the establishment of the communication channel.

17. Apparatus as claimed in claim 14 or 15, wherein the means for determining comprises means for establishing whether or not sufficient incoming channel capacity is available at the second communication system for supporting the communication channel from the first communication system.

18. Apparatus as claimed in claim 15, wherein the means for determining comprises means for ascertaining whether or not it is more cost effective to instigate the establishment of the communication channel at the first or second communication system.

19. Apparatus as claimed in claim 18, wherein said means for determining is located at a third communication system connected to said first and second communication systems by said at least one computer network.

20. Apparatus as claimed in claim 19, further comprising the means for maintaining at the third system data relating to the first and second communication systems for use by the determining means, said data including data representative of the prevailing call tariffs at said first and second communications systems.

21. Apparatus as claimed in claim 20, wherein the means for maintaining the data includes means for receiving updates from said first and second communications systems concerning their respective call tariffs.

22. Apparatus as claimed in any of claims 19 to 21, wherein said first and second communication systems are connected to the third communication system by the Internet.

23. Apparatus as claimed in claim 18, wherein said means for determining is located at said first or second communication system, which exchange messages therebetween to perform said determination.

24. Apparatus as claimed in claim 23, wherein said at least one communication network comprises the Internet, and said first and second communication systems exchange messages over the Internet.

25. Apparatus as claimed in any of claims 18 to 24, wherein the means for determining further comprises

means for transmitting a message from the first communication system, which originally desires the communication channel to be established, to said second or third communication system,

means for waiting a predetermined period of time for a response to the transmission, and

means for deciding in the absence of a reply within said predetermined time period that said first communication system should establish the communication channel.

26. Apparatus as claimed in claim 14, wherein the determining means comprises

means for ascertaining that there is insufficient available outgoing channel capacity from the first communication system to support the communication channel but sufficient available outgoing channel capacity from the first communications system to transmit a request for the communication channel to be established; and

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means for transmitting a message using said available outgoing channel capacity containing an indication that the second system should instigate the establishment of the said communication channel.

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Claims searched: 1-26

Examiner: Al Strayton
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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.O): H4K: KED; KEX; KF42; KTK; KTM

Int CI (Ed.6): H04M, H04Q

Other: ONLINE: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 93/16544 A1 (ERICSSON) See esp: p.10, 1.25 - p.11, 1.2; p.16, 1.12 - p.18, 1.11	1,2,5-8,10,14,15,18-21,23
X	US 5 027 387 (MOLL) See esp: col.3, 1.54 - col.4, 1.20.	Ditto

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.